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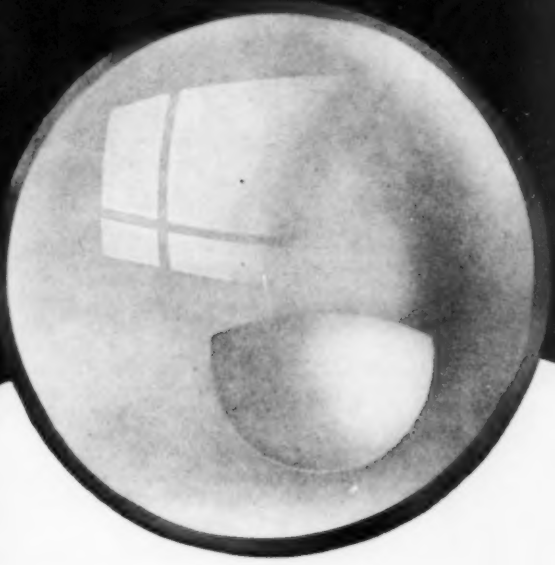

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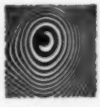

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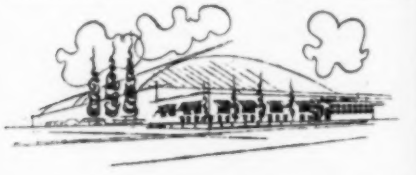

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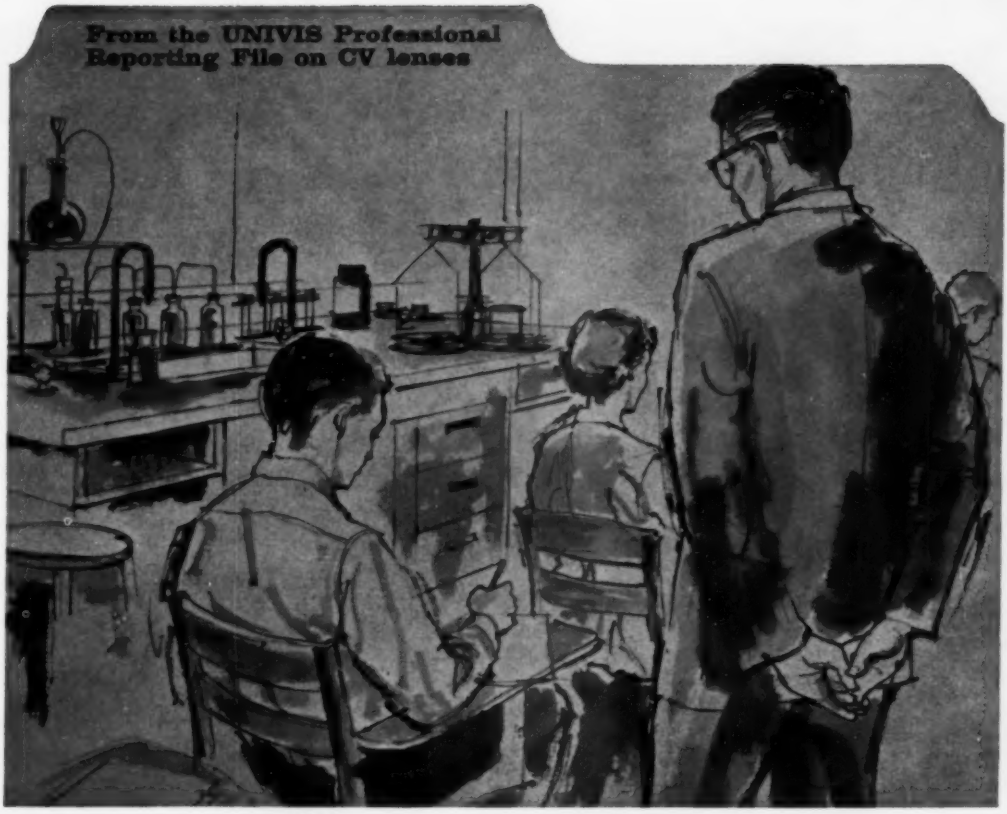

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PERSONALITY AND PHYSICAL VARIABLES AS RELATED TO REFRACTIVE ERRORS*

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INTRODUCTION

Through the years, many theorists and investigators have contended that certain constitutional factors in the individual were related to one another and in turn were related to the presence of specific physiological disturbances. This writer, through research, clinical observation and study, has developed an increasing curiosity as to the possible existence of a relationship between constitutional factors, both physical and personality, and refractive error.

REVIEW OF THE LITERATURE

Physique and Personality. The relationship between physique and personality was established by the work of Kretschmer[1] and Sheldon.[2]

Ernst Kretschmer, a German psychiatrist, was greatly influenced by Kraepelin's two great psychopathological types: the manic-depressive or "circular" insanity, and dementia praecox (later called schizophrenia by Bleuler), under which most of the non-organic psychoses were supposed to fall. Using these psychological types as a basis, Kretschmer observed that his manic-depressive patients were of the stocky, compact build. These he called pyknics. He further noted that his schizophrenic patients were either of the slender, linear type or of the muscular type. These he called asthenics and athletics, respectively.

Kretschmer's great contribution to psycho-biological literature lay in the fact that he was the first modern student to demonstrate a quantitative relationship between physical constitution and clinical manifestations. His method of physique classification was criticized by many authorities because of his assumption that every individual could be placed into one of three types and because of his apparent failure

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to recognize both the possibility of a mixture of types and the concept of continuous distribution of people and of physiques.

Using Kretschmer's work as a basis, but eliminating the typological aspects of this method, William Sheldon worked out a system of physique classification which held that everyone is made up of varying degrees of three components. These components correspond closely to Kretschmer's three types, but allowed for a mixture of these types. In a later work, Sheldon linked specific physiques with specific temperaments. The temperament types were original and did not correspond to Kraepelin's which Kretschmer had used.

Disease and Physique. Draper,[3] in his clinical observations at New York Presbyterian Hospital, differentiated between a "gall bladder type" physique and an "ulcer type." He demonstrated that gall bladder patients are usually of thick, stocky build, while ulcer patients tend toward the linear development and represent something of a physical opposite to the gall bladder type.

Draper and Dupertuis[4] found that polio patients who became afflicted with paralytic complications are principally the compact, athletic type.

Psychic Factors and Refractive Condition. Closer to the sphere of interest of this paper is the possible existence of psychic factors in such apparently physical visual disturbances as refractive errors. Dunbar[5] states that there are people in whom temporary or permanent near-sightedness can be brought on by the workings of the mind, and she feels that people with this condition should be treated as a whole, rather than by the prescribing of lenses alone. The effect of hypnosis on refractive error was mentioned by Le Cron[6] when he wrote of the near-sighted subject who exhibited a marked improvement in uncorrected visual acuity under hypnosis as compared to his acuity in the non-hypnotic state. The degree of neurosis manifested by subjects of differing refractive conditions was studied by Schultz[7] recently. Although the group studied was small, the general conclusion was that far-sighted subjects were significantly more neurotic than the near-sighted subjects and the subjects with no refractive error.

Many writers have expressed opinions concerning personality traits of near-sighted individuals. Goddard,[8] writing primarily about uncorrected near-sighted persons, stated that these people were optimistic, euphoric and ardent in their actions. These characteristics were said to disappear when they began wearing their appropriate lens correction. This writer does not consider these as constitutional characteristics, but mentions them only because they do relate to personality and refractive

condition. Harrison[9] observed that defective vision produced a bad mixer: a person who was introspective and selfish. Gould,[10] in describing the personality of the near-sighted individual, used such terms as meticulous, dogmatic, tyrannical and egotistical.

These views concerning near-sightedness and the fact that they had no statistical basis led Schapero and Hirsch[11] to conduct a study on the relationship of refractive error to personality traits as indicated by their subjects' performance on the Guilford-Martin Temperament Test. Near-sighted individuals showed a tendency to have inhibited dispositions, over-control of emotions, inertness and disinclination for motor activity. They also achieved a higher score in social leadership. In contrast, the far-sighted subjects tended to be carefree, lively, impulsive, liked vigorous activity but were socially passive. These tendencies were in general agreement with the popular view; however, the degree of association was so slight as to be of almost no predictive value.

In clinic work, the writer has noted that the progression of the near-sightedness seemed to be greater in youngsters who had grown rapidly between successive visual examinations, in comparison with those who had grown more slowly. This apparent trend was another factor stimulating his interest in the relationship between physical make-up and refractive status.

Some of the material cited is based on experimental evidence and some is unsupported theory, but both helped motivate this paper concerning the relationships between personality, physique and refractive status. Specifically, the object of this study is to determine whether subjects with common refractive conditions have similar personality and physical characteristics, and whether subjects of differing refraction differ significantly as to their physique and personality.

PHYSIQUE CLASSIFICATION

The work of Kretschmer[1] had the greatest impact in the field of constitutional psychology because it was the first systematic study linking physique to personality. Other writers prior to his time took such a relationship for granted and felt no need for justifying statistics. His first work was published in 1925 and dealt primarily with psychotic patients confined in the mental institution in which Kretschmer served as staff psychiatrist. This was in Marburg, Germany, and his subjects were, for the most part, Schwabian Germans. He noted a difference in physical appearance among manic-depressives as contrasted to schizophrenics. Although at first glance the difference was not always striking, closer observation invariably revealed a significant difference.

PROBLEMS AND PROGRESS

Tanner[12a] points out that the three problems that beset the classifier of physique are mainly problems of logical and scientific procedure. These include (a) choice of variables, (b) measurement versus appearance, and (c) types versus components.

Choice of Variables. Early investigators attempting to classify physique based their classifications on certain selected physical characteristics which they felt were most important. It soon became apparent, however, that this approach was not valid since there was no limit to the number of individual characteristics and each of these was not without some significance. The five methods now in use are based on a different approach which cosiders primarily the configuration of the entire body.

Measurement versus Appearance. This means measuring body parts rather than global appearance as a basis for the particular system of classification. The visual and metric approaches have been brought together by the advent of photogrammetry, or measurement by means of photography. This is the method employed by Sheldon.

Types versus Components. Three of the five contemporary methods of physique classification are typologies. These contend that an individual falls into one of three or four discrete categories. They do not explain the cases that might not fall into a single class. Later investigators asserted that typologies did not do justice to the degrees of complexity observed in body structure. Sheldon and the supporters of factor analysis felt that an individual's physique is not just one type or another, but is made up of several components in differing degrees.

The five contemporary methods of classifying physique still in current use are Factor Analysis and those of Sigaud, Kretschmer, Viola and Sheldon.

Sigaud. One of the earlier physique classification schemes, although virtually obsolete now, was that of Sigaud.[12b] He used a fourfold typology, wherein the majority of mankind is divided into digestives, respiratories, musculars and cerebrals. It was a pure typology with no hint of the later doctrine of continuously variable components. This obsolescence and lack of objectivity make it unattractive for general use.

Viola. This was the first method to give a comprehensive plan for the external measurement of the entire body. Because of this fact, it represented a significant contribution. It is not too well known in this country due to lack of available translations.

According to Tanner,[12b] this classification does everything to turn from a typology to a component system except take the final step. Viola's

method placed subjects along a linearity-non-linearity continuum on the basis of a rather complicated combination of ten body measurements. After mathematical manipulation, these measurements gave a number which he called the "Morphological Index." A high morphological index indicates a linear individual or microsplanch, a low index showed a compact or macrosplanchnic individual. As it stands, this system is basically a dichotomy, but could be turned unaltered into a single continuously variable component of build with the linear extreme at one end and the compact extreme at the other.

Kretschmer. As mentioned previously, this classification is well known and was devised against a background of psychiatry. It is a typology consisting of three types: (a) the pyknic or the short, stocky, moderately rotund individual with whom was associated the manic-depressive personality; (b) the muscular, broad-shouldered, powerfully built individual called the athletic and identified with the schizoid personality as was (c) the leptosome or the slender, linear individual. The physique types originated by Kretschmer have never been clearly illustrated by photographs or satisfactorily delineated by measurement and for this reason have been used very little.

Like Viola, Kretschmer attempted to differentiate his types in terms of a system of anthropometric measurements. Paterson[13] points out that even with these measurements there is a good deal of jumble and confusion in the description of the material.

Several American psychiatrists have become followers of Kretschmer, and two or three attempts have been made in this country to transform his concept of types into statistical variables. Of these, the best known and perhaps the most carefully executed is that of Wertheimer and Hesketh.[14] At the Henry Phipps Psychiatric Clinic these investigators revived, in shortened form, the morphological index of Viola, with some of the trunk measurements omitted. They classified 65 male patients by Kretschmer's method, calculated the morphological indices for these patients, and demonstrated that all the Kretschmer asthenics were in the microsplanchnic range, and the pyknics in the macrosplanchnic range. They then correlated the morphological index with psychotic temperament, and found much the same distribution that Kretschmer had reported. That is to say, the macrosplanchnics were on the whole, manic-depressive, and the microsplanchnics were predominantly schizoid.

Sheldon. After considerable research upon the methods of Kretschmer and Viola, Sheldon[15a] decided that an adequate classification of physique would have to be founded upon (1) the study of a much larger

number of subjects of homogeneous age, (2) a method of attack which viewed the human physique as made up of an intermixture of components rather than as an example of a type, (3) a procedure for dividing the body into segments or regions for the purposes of comparative measurement and classification, and (4) a technique of comparison based upon permanent photographic records rather than upon isolated anthropometric measurements alone.

Sheldon's classification is based upon the contention that an individual's physique can be described by assigning it a value of from one to seven in each of three components. The components were named endomorphy, mesomorphy and ectomorphy on a theory, not generally accepted, of their genesis from their embryonic germ layers. The first component or endomorphy indicates the degree that the individual approaches the spherical. The second component or mesomorphy indicates the amount of muscular or athletic type build possessed by the individual. Ectomorphy, the third component, is the indicator of extreme linearity. The build of each individual is assigned a number for each component indicating the degree of each component present. This is the individual's somatotype and would be shown by such combinations as 433, 344, etc.

The contributions of Sheldon were important because they represented a further extension and improvement upon the methods of Viola and Kretschmer. Today this work is regarded as a contemporary classic in the field of constitutional psychology. The greatest drawback to using the Sheldon technique is that it is done photogrametrically from a nude photo of the subject. This feature definitely limits its use, particularly when the subjects are volunteers of both sexes.

Factor Analysis. For complete objectivity, this method when perfected, should be better than any of the methods previously discussed. Factor analysis consists of reducing a large number of measurements, all of which are inter-correlated, to a smaller number of factors which account for most of the variability defined by the original measurements. All physical measurements are positively correlated and this gives rise, under most factorial techniques, to a general factor of gross size, with which all measurements are correlated. After this there remain several group factors, which can themselves be subdivided into smaller groups.

Burt,[16] Tanner,[17] Thurstone,[18] and Howells[19] have written extensively on factor analysis as applied to physical measurements, but not in the detail necessary for repetition.

Ponderal Index. This is determined by mathematical computa-

tion and is used by many anthropologists as a gross indication of the linearity of human physique. This is done by dividing the subject's height (inches) by the cube root of his weight (pounds). This is not a precise somatotype but offers a valuable indication of the approximate somatotype for the body as a whole.

The rationale of the ponderal index is, that if the body is assumed to be of constant density, the cube root of the weight would yield a value proportional to the length of the side of a cube equal to the body in volume. Division of this value into the height of the subject can therefore be regarded as the division of a length by a length.

This method was adopted for this research for it offers a simple technique of determining a single continually varying component similar to the morphological index of Viola. To employ this method, one must place the subject on a linearity versus non-linearity continuum with a high index indicating a more linear build and a low index a more compact build. If the index is between the high and low, it indicates a mixed component build.

THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY

A testing device was sought that would give information about some of the more important aspects of personality on the subjects tested. There were many general methods of testing personality to consider and many tests under each general method. The test desired for this study should meet the following criteria: (1) be relatively easy to administer and score; (2) be valid and reliable; (3) be widely accepted and used in the field of psychology, and (4) give an objective, qualitative evaluation of the subject's personality which could be used for comparison between subjects of differing refractive conditions. The Minnesota Multiphasic Personality Inventory filled all the established requirements and thus was selected as the personality testing instrument for this research.

The Minnesota Multiphasic Personality Inventory (MMPI) is a self-rating psychometric questionnaire, designed to provide in a single test scores on all the more important phases of personality. McKinley and Hathaway[20] began the construction of this multiphasic personality schedule in 1937. The test was intended for use by physicians to help recognize abnormal psychological states. Originally it contained 504 items selected from psychiatric texts, psychiatric examination direction forms, and from earlier forms of structured personality inventories. The individual taking the test answers these items as true, false, or cannot say, by sorting them into three categories when taking the card form, or by marking answers on an IBM answer sheet when taking

the booklet form. The authors selected the items composing most of the scales on the basis of the ability of each item to differentiate between a normal group of individuals and a criterion group of clinically diagnosed abnormals who exhibited relatively pure psychiatric syndromes. The scales were developed by contrasting the normal groups with carefully selected studies of clinical cases of which over 800 were available from the neuropsychiatric division of the University Hospitals when the test was published. A high score on a scale has been found to predict positively the corresponding final clinical diagnosis or estimate in more than sixty per cent of new psychiatric admissions. Even when a high score was not followed by a corresponding diagnosis, the presence of the trend to an abnormal degree in the symptomatic picture was nearly always noted.

SCALES

There are four validating scales and many clinical scales. The four validation scales included in the inventory are: the cannot say (?) category, a lie scale (L), a validity scale (F), and a suppressor variable (K). The clinical scales supposedly measure the degree to which an individual deviates from a normal group in his reaction to items, differentiating such a group from a criterion group possessing a characteristic abnormal syndrome of behavior. The criterion groups include Hyprochondriasis (Hs), Depression (D), Hysteria (Hy), Psychopathic deviate (Pd), Masculinity-feminity of interest (Mf), Paranoia (Pa), Psychasthenia (Pt), Schizophrenia (Sc), Hypomania (Ma) and Social Introversion (Si). A brief description of both the validating and clinical scales is found in Table 1 taken from Cottle.[21a]

Another scale or rather a combination of three clinical scales not shown in the table is the Neurotic Triad. The authors of the MMPI feel that the D scale in conjunction with the Hs and Hy tend to identify psychoneurotics, hence the title: Neurotic Triad. It was used in this research by adding the three scores together which gave a score for the neurotic triad.

USES OF THE MMPI

In Clinical Psychology and Medicine. Leverenz[22] used the MMPI on the psychiatric service of a station hospital. It gave direction in evaluating psychiatric disorders, assistance in categorizing personality disturbances and gauging severity of the case. It helped in evaluating borderline conditions and mixtures of psychiatric syndromes and aided in the diagnosis and prognosis of men subject to dismissal from the armed services for personality disorders. Others report using the test in a similar manner for the identification or clarification of diagnosis for pathological groups.

TABLE 1
BRIEF DESCRIPTION OF SCALES OF THE MMPI

MMPI	Variable	Test Author's Description
?	Cannot Say Category	Includes items which subject can answer neither true nor false
L	Lie Factor	Falsify scores by choosing most socially accepted response
F	Validity	Check on validity of test-rationalé and pertinent responses, did subject understand items
K	Correction Factor	Acts as suppressor variable to increase discriminatory power of five clinical scales
Hs	Hypochondriasis	Amount of abnormal concern about bodily functions
D	Depression	Depth of clinically recognized symptom complex, depression
Hy	Hysteria	Conversion-type hysteria symptoms
Pd	Psychopathic Deviate	Absence of deep emotional response, inability to profit from experience, disregard of social mores
Mf	Masculinity-Femininity	Tendency toward masculine or feminine interests
Pa	Paranoia	Suspiciousness, over-sensitivity, delusions of persecution
Pt	Psychasthenia	Phobias or compulsive behavior
Sc	Schizophrenia	Bizarre and unusual thoughts or behavior
Ma	Hypomania	Marked over-productivity in thought and action
Social Introversion		High score indicates social introversion

The Minnesota Nutritional Studies used the MMPI a great deal in their experimentation. It was used to measure the effects of restricted intake of vitamins of the B complex,[23] the effect of experimental starvation[24] and the relationship between food-aversion checklist and MMPI scores.[21b] These studies indicated the following trends: the conditions of vitamin B deficiency and semi-starvation were accompanied by higher neurotic triad scores, and there appeared to be little relationship between food aversions and the MMPI answers.

The use of the MMPI to measure effects of various therapies is reported. Feldman[25] attempted to produce a scale of MMPI items to select patients who might respond successfully to shock therapy. MMPI patterns were studied on patients before and after insulin shock therapy.[26] Many other similar studies are on record.

Several studies of organic conditions using the MMPI are on record. Tuberculous[27] patients were compared with normals on their MMPI responses. Tuberculous males scored significantly higher than the normals on the neurotic triad. Tuberculous females had significantly higher scores on the Pd, Pa and neurotic triad scales.

In High Schools, Colleges and Occupations. According to Cottle.[21e]

studies dealing with high school age populations are confined mostly to investigations of delinquent behavior, although scales for achievement, social status and social introversions have been reported. Studies of college students can be divided roughly into the following areas: those dealing with general screening for attitudes and personality traits; those dealing with achievement; those dealing with the relationship of ability, interest and psychopathology; and those dealing with specific curricula, particularly teacher training. It has been used very little in vocational selection in spite of the fact that the validating scales offer an excellent check on the honesty with which it is answered. Research has shown that personality factors are as important in personnel selection as ability and interest. These research projects include a study of women clerical workers, saleswomen and women optical workers; a study of male insurance agents and female social workers; a study of male artists; a study of professional actors; a factorial study of submarine personnel, and the vocational advisement of veterans. A complete bibliography of the various studies where the MMPI has been used may be found in Cottle's[21d] work.

EVALUATION OF THE MMPI

The major advantages of self-rating questionnaires are that they are relatively easy to score, easy to administer and they offer an objective qualitative score in specific areas of personality. The MMPI possesses all these advantages plus certain assets unique to it. Most of these types of tests have two main defects: their validity is uncertain, and they are easy to fake. Because of the amount of research and usage, the MMPI appeared to be the best choice.

METHODS AND PROCEDURES

The working hypothesis for this study is that individuals of differing refractive conditions differ as to personality and physique. The direction of the relationship is not included because there is no basis upon which such a prediction might be made. In terms of the criteria used to evaluate personality and physique in this investigation, the research hypothesis is restated as follows: emmetropes, myopes and hypermetropes differ from one another with regard to their MMPI score and their ponderal indices.

SUBJECTS

This research was begun in August, 1957, and completed in July, 1958. It was conducted in the Optometry section of the Southern California Permanente Medical Group Clinic, Fontana, California. Approximately ninety per cent of subjects were patients in the clinic who requested visual examination. The remaining ten per cent were made

up of employes of the clinic or the adjacent Kaiser Foundation Hospital. Individuals between the ages of 18 and 38 of both sexes were selected. The non-pathological refractive conditions of emmetropia, myopia and hypermetropia were the only ones considered. Emmetropes included those subjects whose refractive error was plus or minus 0.75 or less. Myopes includes those whose refractive error was 1.00 diopter or more of simple myopia, simple myopic astigmatism or compound myopic astigmatism. The category of hypermetropia included those subjects whose refractive conditions was 1.00 diopter or more of simple hypermetropia or hypermetropic astigmatism. Individuals with anisometropia or mixed astigmatism were not included.

The subjects were paired off for comparison of MMPI scores and ponderal indices on the basis of similarity as to age, sex, marital status, educational background and verbal ability. These particular characteristics were selected because it was felt they would have some bearing on the manner the individual subject answered the items in the MMPI. Although it is unlikely that these characteristics would affect the ponderal indices, for the sake of uniformity, the same technique was followed. Information on all the characteristics with the exception of the verbal ability was taken from the subject's history as recorded on the data sheet. An estimate of verbal ability was made by giving the prospective subject a written vocabulary test consisting of twenty selected items taken from a one hundred item multiple choice test regularly given to freshmen candidates at the University of Southern California.

Tables 2 though 6 give a frequency distribution on each of the matching characteristics and provide the basis for the matching which had yet to take place.

TABLE 2
FREQUENCY TABLE OF MARITAL STATUS OF MALE AND FEMALE SUBJECTS

	Male		Female	
Marital Status	Number	Percent	Number	Percent
Married	34	53.0	49	73.0
Single	29	45.3	16	23.5
Divorced	1	1.7	2	3.5

After perusing the tables of the various characteristics, certain trends become apparent: more female than male patients appear: there is a relative scarcity of hypermetropes as compared to the other refractive classifications: on the average, female subjects were slightly younger than the male: and the male subjects as a whole were better educated than the female.

Procedure. During the course of the daily refraction appoint-

TABLE 3
FREQUENCY DISTRIBUTION TABLE ON THE AGES OF MALE AND FEMALE SUBJECTS

Age	Male	Female
38	1	5
37	2	3
36	4	0
35	3	4
34	3	3
33	0	3
32	0	3
31	3	3
30	4	3
29	5	2
28	1	5
27	4	2
26	3	4
25	3	3
24	2	1
23	2	2
22	0	4
21	0	2
20	1	5
19	2	3
18	1	7
	N — 44 Mean — 27.7 Median — 29	N — 67 Mean — 27.4 Median — 28

TABLE 4
FREQUENCY TABLE OF EDUCATION BACKGROUND OF MALE AND FEMALE SUBJECTS

	Male		Female	
Education	Number	Percent	Number	Percent
Graduated from College	15	34.3	14	21.1
Attended College but didn't graduate	16	36.3	16	23.8
Graduated from High School	10	22.5	28	41.7
Failed to Finish High School	3	06.7	9	13.4

ments, any patient meeting the requirements was asked if he would be willing to serve as a subject in this research project. If the patient showed interest, the purpose of the study and the patient's role as a subject was explained to him. Virtually all patients accepted readily.

A routine history, examination for ocular pathology, and refraction was performed on each subject to assure his meeting the visual requirements. The subject was then weighed and his height measured, both with clothes and shoes on. The subject was then shown the vocabulary test and instructed in its use. A copy of the test is shown in Appendix B. The subject then completed the test in one of the clinic examining rooms.

A data sheet (Appendix A) on the subject was then filled out, giving the known background characteristics on the subject. The MMPI

TABLE 5
FREQUENCY DISTRIBUTION OF VOCABULARY TEST SCORES

Test Scores	Male	Female
20	0	0
19	1	1
18	3	7
17	2	6
16	3	6
15	6	4
14	6	2
13	3	8
12	3	5
11	1	1
10	2	2
9	4	4
8	1	0
7	1	2
6	2	2
5	2	8
4	0	3
3	2	2
2	1	3
1	0	0
0	1	1
	Mean — 11.7 Median — 13.0	Median — 13.0 Mean — 11.2

TABLE 6
FREQUENCY DISTRIBUTION OF SUBJECT'S REFRACTIVE ERRORS

	Male		Female	
Refractive Status	Number	Percent	Number	Percent
Emmetropes	16	36.4	24	35.8
Myopes	17	38.6	24	35.8
Hypermetropes	11	25.0	19	28.4

test booklet was then introduced and its use explained. The subject was asked to take the test if he had available time. If he did not have the time, an appointment was made for him to return and to take the test at a later date.

In summary, three groups of matched pairs were selected. There were a group of pairs comparing emmetropes with myopes, emmetropes with hypermetropes, and myopes with hypermetropes. The pairs in each group were matched as to the variables of age, sex, marital status, educational background and verbal ability. The difference in MMPI score and ponderal indices was computed for each matched pair and recorded.

METHOD OF HANDLING DATA

When the testing material on an individual subject was completed, he was given an identification number and this number was placed on each piece of completed test material. The vocabulary test was then hand-scored and the number of correct items entered on the data

sheet. The characteristics to be matched were then coded and entered on the data sheet. As soon as possible, the subject was matched with another with similar characteristics but with differing refractive error. When a group of these matched pairs had accumulated, their MMPI answer sheets were sent to the University of Southern California for machine scoring. When the scored profiles were returned, they were entered on the subject's data sheet.

Computation of the Ponderal Index. The final finding needed before entering into the statistical portion of the study was the ponderal index on each subject. By definition, the ponderal index is the subject's height in inches, divided by the cube root of his weight in pounds. This could have been calculated using the formula: however, a nomograph available in Sheldon[28] was used for determining the index.

STATISTICAL METHOD

The selection of an appropriate statistical test was based upon the following needs: the test must not be dependent upon knowledge of the parameters in the population from which the research sample was drawn: it must be able to handle small samples with accuracy: and it must be able to deal with groups of matched pairs satisfactorily. A non-parametric method was needed and the Wilcoxon Matched-pairs Signed-ranks Test[29a] was very suitable for such a study and was the one chosen.

The Wilcoxon test is most useful for the behavioral scientist. With behavioral data, it is not uncommon that the researcher can (a) tell which member of a pair is "greater than" which, and (b) rank the difference in order of absolute size indicating whether the difference is plus or minus. That is, he can make the judgment of "greater than" between any pair's two performances, and he can also make that judgment between any two difference scores arising from any two pairs. He can then obtain a sum of the positive ranks and a sum of the negative ranks. If the null hypothesis holds, the sum of the positive ranks will equal the sum of the negative ranks. This fact is the underlying principle behind this type of test.

In using small samples (less than 25), the smaller sum of the like-signed ranks is called "T." Table G (Siegel)[29b] gives the various values of T and their associated levels of significance for small samples. This table is adapted for use with both one and two-tailed test: however, in this study, the two-tailed procedure was followed because the direction of the difference was not predicted in advance.

DIFFICULTIES ENCOUNTERED

Several difficulties were encountered which tended to delay com-

pletion of the study. Only seventeen per cent of the total patient load qualified as to age. There were about two females for every male among the available subjects. Hypermetropic subjects in the age group under consideration were exceedingly rare. The fact that the subjects were matched on the basis of five variables made it necessary that many more subjects be screened than were actually used to assure matching.

RESULTS

The results of this research are listed in tabular form on each comparison group. Both the five and the one per cent level of significance[29c] are shown in the table as determined by the statistical method together with an indication as to whether the particular "T" found was significant. If T is a higher number than the number given for the five per cent level, it is not significant and the null hypothesis is not rejected. If T is a lower number than the number shown for the five and/or one per cent level, it is significant and the null hypothesis rejected. The size of the number indicating the level of significance varies directly as the "N." For example, when N equals 20 the five per cent level is 52 but when N equals 17, the five per cent level is 35.

Table 7 is constructed so that the eleven personality variables and the one physical variable are given in groups of three. The three are for groups of emmetropes compared with matching myopes, emmetropes compared with matching hypermetropes, and myopes compared with matching hypermetropes. This makes a total of 36 separate statistical computations. It will be noted upon examining the table that in only four of the 36 comparisons were the results found to be significant, and these only at the five per cent level.

Table 7 revealed significant results at the five per cent level in four of the entries. The psychopathic deviate scale comparing emmetropes with hypermetropes shows the hypermetropes to have significantly higher scores than the emmetropes. The ponderal indices in all three comparisons listed were significant. Emmetropes had significantly higher ponderal indices than myopes. Emmetropes had significantly lower ponderal indices than hypermetropes. Hypermetropes had significantly higher ponderal indices than myopes.

SUMMARY AND CONCLUSIONS

SUMMARY

There were two general objectives in conducting this study: (1) to determine if there were any significant personality differences between matched subjects of differing refractive conditions, as indicated by their scores on the Minnesota Multiphasic Personality Inventory, and (2) to determine if there were any significant physical differences between

TABLE 7

SUMMARY OF THE WILCOXON SIGNED-RANK TEST RESULTS BETWEEN THE REFRACTIVE TYPES WITH REGARD TO THE VARIOUS PHYSICAL AND PERSONALITY SCALES UNDER CONSIDERATION

Refractive Groups Compared	N	Scales	T	Level of Significance .05	.01
Emmetropes vs. Myopes	20	Psychopathic Deviate	95.5	52	38
Emmetropes vs. Hypermetropes	17		34.0*	35	23
Myopes vs. Hypermetropes	18		57.0	40	28
Emmetropes vs. Myopes	19	Interest	77.5	46	32
Emmetropes vs. Hypermetropes	19		86.0	46	32
Myopes vs. Hypermetropes	19		87.5	46	32
Emmetropes vs. Myopes	18	Paranoia	85.5	40	28
Emmetropes vs. Hypermetropes	17		63.5	35	23
Myopes vs. Hypermetropes	19		84.0	46	32
Emmetropes vs. Myopes	19	Psychasthenia	94.5	46	32
Emmetropes vs. Hypermetropes	18		71.5	40	28
Myopes vs. Hypermetropes	18		58.5	40	28
Emmetropes vs. Myopes	19	Schizophrenia	88.0	46	32
Emmetropes vs. Hypermetropes	20		92.0	52	38
Myopes vs. Hypermetropes	20		99.5	52	38
Emmetropes vs. Myopes	20	Manic-depressive	65.0	52	38
Emmetropes vs. Hypermetropes	20		102.0	52	38
Myopes vs. Hypermetropes	20		81.0	52	38
Emmetropes vs. Myopes	20	Social Interest	87.5	52	38
Emmetropes vs. Hypermetropes	20		79.5	52	38
Myopes vs. Hypermetropes	18		68.5	40	28
Emmetropes vs. Myopes	17	Hysteria	75.5	35	23
Emmetropes vs. Hypermetropes	18		50.5	40	28
Myopes vs. Hypermetropes	20		55.5	52	38
Emmetropes vs. Myopes	17	Hypochondriasis	69.5	35	23
Emmetropes vs. Hypermetropes	19		62.5	46	32
Myopes vs. Hypermetropes	18		66.6	40	28
Emmetropes vs. Myopes	20	Depression	55.0	52	38
Emmetropes vs. Hypermetropes	20		66.0	52	38
Myopes vs. Hypermetropes	17		67.0	35	23
Emmetropes vs. Myopes	20	Neurotic Triad	84.5	52	38
Emmetropes vs. Hypermetropes	20		70.0	52	38
Myopes vs. Hypermetropes	19		67.0	46	32
Emmetropes vs. Myopes	20	Ponderal Index	47.0*	52	38
Emmetropes vs. Hypermetropes	20		38.5*	52	38
Myopes vs. Hypermetropes	20		45.5*	52	38

*Significant at the five percent level

matched subjects of differing refractive conditions as indicated by their ponderal indices.

Patients and employees of the Southern California Permanente Medical Group Clinic served as volunteer subjects for this project.

The following data were obtained on each subject: age, sex, marital status, vocabulary test score, and educational background. The subjects were matched and paired off on the basis of these characteristics.

Normals were paired with matching near-sighted and far-sighted subjects, while the near-sighted were paired with matching far-sighted subjects. The subject's score on the eleven desired scales of the MMPI was determined together with his ponderal index. The data were tabulated and the difference in score calculated on each matched pair. It was then tested for significance using the "Wilcoxon Matched-pairs Signed-ranks Test."

From the data obtained, the results may be summarized as follows: (1) hypermetropes had significantly higher psychopathic deviate scores than emmetropes; (2) emmetropes had significantly higher ponderal indices than myopes; (3) emmetropes had significantly lower ponderal indices than hypermetropes; (4) hypermetropes had significantly higher ponderal indices than myopes.

DISCUSSION

Since in only a single instance out of a possible 33 was there a significant finding linking personality and refractive error, it can be safely said that on the basis of the results of this study, the first portion of the hypothesis is not accepted.

Conversely, in all three statistical tests involving the physique indicator and refractive status, a significant result was forthcoming. This fact tends to support the second portion of the research hypothesis. In other words, there is no relationship between an individual's MMPI scores and his refractive error, but a relationship between his ponderal index and his refractive condition appears to exist.

How can one explain this apparent relationship between physique and refractive error? One way would be to postulate the existence of common etiological factors. One theory that they both have in common concerns the role of the endocrines in the development of the visual mechanism and of the configuration of physical characteristics.

Discussion of the influence of glandular defects upon the development of the refractive apparatus has pervaded the literature for many years. Pascal[30] writes that a number of investigators have found a definite relationship between progressive, non-pathological myopia in youth and adolescence, and insufficiency of the thyroid gland. Sheldon,[15b] in discussing the influence of the endocrines on somatotype, says that the Italian anthropologists a generation ago knew that at least some of the ectomorphs were hyperthyroid. His studies shed light upon a few specific points, the endocrines and physique.

Normal persons who are mesomorphic ectomorphs (relatively high ponderal indices) show an average basal metabolism reading at

least 20 points higher than normal individuals of the same age who are predominantly mesomorphic endomorphs (relatively low ponderal indices). In this study, hypermetropia was found to exist in subjects with a higher ponderal index rather than emmetropia and myopia. From this it appears that myopic subjects might have a tendency toward hypothyroidism while a similar relationship could exist between hypermetropia and hyperthyroidism.

Another rather interesting phenomenon mentioned by Sheldon[2] is variance in rate of physiological sexual maturation in certain somatotypes. Female ectomorphs (high ponderal index) mature slowly and menstruate late, while endomorphs mature much earlier. Although not a part of this study, this writer has noted in clinical optometric work the tendency for the youngster who matures early with rapid growth to become myopic more rapidly and to a greater degree than the individual with slower maturation and growth. It is entirely possible that this apparent connection between body pattern and visual function may be wholly or partially due to some type of sub-clinical endocrine disturbance.

The theories currently offered concerning the etiology of both refractive errors and variations in physique represent the well-worn conflict between the supporters of heredity versus environment. Although the sphere of interest of this writer was but three aspects of the human constitution, these theories would apply to all of the enduring personal qualities—anatomical, physiological and psychological—that form the basis for classifying individuals and make up their constitution.

The following hypothesis is proposed to explain the relationships found in this investigation: all constitutional characteristics are the products of the play of a complex pattern of environmental pressures upon a living organism that carries an innately predetermined constitutional pattern.

This writer would like to see further research conducted along the same lines as his to establish its validity. Incorporated in these studies would be the classification of physique using Sheldon's somatotyping procedure and the evaluation of personality. This classification and evaluation would not be from the abnormal type or syndrome method, such as the MMPI yields, but from the measuring of variation in traits that characterize so-called "normal" individuals. This writer feels that if such a study were carried out, it would add another constitutional characteristic, refractive status, to the theories of Kretschmer and

Sheldon who have linked physical and personality patterns together.

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APPENDIX A

DATA SHEET

Name ..... Date .....
Address ..... Phone .....
Distance Refractive Error: O. D. .....
O. S. .....
Age: ..... years
Sex: .....
Marital Status: .....
Education: .....
Vocabulary Score .....

Height ..... inches
Ponderal Index .....
Weight ..... pounds

MMPI Scales Scoring

Hs.	.....	Pa.	.....
D	.....	Pt.	.....
Hy.	.....	Sc.	.....
Pd.	.....	Ma.	.....
Mf.	.....	Si.	.....

APPENDIX B

Vocabulary Test

Name.....
Last First

Underline the word that means the same or nearly the same as the first word in each item.

(Example)
giraffe
1. bird
2. fish
3. animal

7. *unimaginative*
1. immodest
2. intractable
3. intrusive

14. *inundation*
1. conflagration
2. flooding
3. drought

4. rock
5. school

1. *preposterous*
   1. biased
   2. invalid
   3. dishonest
   4. difficult
   5. nonsensical
2. *unplanned*
   1. idyllic
   2. ramshackle
   3. ill-advised
   4. impromptu
   5. tactless
3. *prosecuted*
   1. persecuted
   2. fined
   3. tried
   4. executed
   5. arrested
4. *vitalize*
   1. vivify
   2. abduct
   3. eavesdrop
   4. immobilize
   5. modulate
5. *utopian*
   1. foreign
   2. ideal
   3. benevolent
   4. practical
   5. inherent
6. *retrospective*
   1. contradictory
   2. perfunctory
   3. fully receptive
   4. backward looking
   5. far seeing

4. phlegmatic
5. immature

8. *constabulary*
   1. barouche
   2. habitue
   3. buttery
   4. gendarmerie
   5. lapidary
9. *exemplary*
   1. imitated
   2. perfunctory
   3. commendable
   4. offensive
   5. infallible
10. *whippet*
    1. hound
    2. ferret
    3. biped
    4. horsewhip
    5. bullfinch
11. *elaboration*
    1. paradox
    2. boorishness
    3. embellishment
    4. succulence
    5. exuberance
12. *misspell*
    1. transliterate
    2. miscalculate
    3. misorthographize
    4. misconstrue
    5. interpolate
13. *sinister*
    1. suspicious
    2. deadly
    3. encouraging
    4. harmful
    5. ominous

4. denudation
5. tornado

15. *lethargy*
    1. lassitude
    2. potency
    3. solitary
    4. deprivation
    5. vitriol
16. *erratic*
    1. deviating
    2. skeptical
    3. misguided
    4. amorous
    5. promiscuous
17. *candidly*
    1. genially
    2. guilelessly
    3. treacherously
    4. impulsively
    5. surreptitiously
18. *burnish*
    1. tarnish
    2. polish
    3. destroy
    4. oxidize
    5. clean
19. *credulous*
    1. creditable
    2. doubtful
    3. credible
    4. unquestioning
    5. trustworthy
20. *albeit*
    1. although
    2. however
    3. peradventure
    4. consequently
    5. ergo

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HYGIENIC CONTACT LENS CARE AND PATIENT COMFORT*

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FOREWORD

The authors are recognized authorities on the subject of the cleansing, wetting, and care of contact lenses. Since this subject is vitally concerned with successful contact lens practice the advice here presented should be studied and applied in daily office routine. Experience has shown that improperly cared for contact lenses become uncomfortable and potentially harmful lenses. Attention to proper office techniques and to patient instruction will result in greatly improved patient success and comfort.

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INTRODUCTION

Patient acceptance of the corneal contact lens has been so satisfactory that by January, 1960, the professions and the industry had placed corneal lenses in the eyes—and, significantly, in the hands—of over five million Americans.[1] Each year, another 500 thousand people discard or supplement their conventional spectacle lenses in favor of contact lenses. Hence, the optometrist must share the burden of teaching and maintaining the professional principles of hygienic lens care. This for two reasons: (1) unhygienic manipulation and storage of lenses is an important underlying cause of patient dissatisfaction with contact lenses: and (2) unhygienic manipulation and storage of lenses may cause eye infections.

CHEMICAL CONTAMINATION

The rejection rate of contact lenses is higher than it should be. The most common complaint of persons who have bought contact lenses and then discarded them is that they "irritate the eyes." Some of these patients—if they are rather strongly motivated to make a successful adjustment to contact lenses—will return time and again to their optometrist in the hope that mechanical adjustments will solve the

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problem. A recent study[2] points out, however, that "fitting error" is responsible for only about 0.2% of rejections; nearly 50% of the patients complain about irritation of the eye by the contact lens and some 25% of the patients reject contact lenses because of the difficulty of insertion and removal of the lens. In other rare cases there are physiologic reasons for the difficulty which are beyond the control of the practitioner—for example, an idiopathic tendency toward excessive and/or abnormal ocular secretion.[3] Wearing difficulties also arise when contact lenses are prescribed at the insistence of patients when clearly, there is a contraindication for the use of contact lenses.

In the great majority of cases the dissatisfied contact lens wearer's difficulties can be traced to inappropriate care of his lenses, either because he has not been properly instructed by his optometrist in how to care for his lenses or because he has not followed his practitioner's instructions faithfully.

The comfortable use of contact lenses depends upon appropriate hygienic habits of lens care. For optical reasons and to prevent irritation, the plastic lens must be kept clean and therefore wettable at all times. In order to keep contact lenses clean, it is not sufficient merely to apply a wetting solution to the surface of the lens before inserting it into the eye, nor to store lenses in an appropriate hydrating solution. Nor is it sufficient that the patient also wash his hands before he inserts his lenses, clean them occasionally, and handle them in such a way that they do not become grossly contaminated with dirt. The patient must also protect his lenses from contamination with bacteria; from chemical substances of any kind which will cause fogging of the lens and impair its wetting properties; and from the accumulation of ocular secretions. For the purposes of this discussion, a "clean lens" is one which is free of all of the contaminants listed in Table I.

TABLE I

Common Contaminants Found on Contact Lenses

Source	*Contaminants*	*Prevention*
Hands	Anionic soaps Nicotine Fats and oils Cosmetics Dead skin Microorganisms	Use recommended hand cleanser (see text); do not rinse off wetting solution before inserting lenses.
Tap water	Microorganisms Chlorine Hydrogen sulfide Mineral salts (calcium)	Use recommended soaking solution and storage kit. (See text.)

If it can be made clear to the patient that his wetting solution and his soaking solution cannot protect his lenses from contamination while he is holding them in his hand, the rest is made easy by the materials which have been developed for his use.

This matter of almost absolute hand cleanliness while the lenses are being inserted is really rather hard to overemphasize. Soaps and detergents ordinarily available in the home for hand-washing purposes are not the ideal cleansing agents for contact lens users. This is because they are hard to rinse off completely from the hands and because lens contamination with even minute quantities of *anionic* detergents significantly impairs the wettability of methylmethacrylate resin. Recently, a specially formulated nonsudsing, *nonionic* and nonirritating hand cleanser* which does not adversely affect the wetting properties of the plastic lens has been developed and marketed for use by the contact lens fitter and his patients.

Much has been said and written about the requirements and characteristics of wetting solutions, and these data are conveniently summarized in a recent paper.[4] A point of emphasis concerning wetting solution, however, is that—especially in the initial stages of adaptation to the lenses—the patient should not rinse off the solution before inserting the lenses into his eyes. Since wetting solution has a much greater covering power than tap water, it will serve much more efficiently as a protective film and will greatly reduce irritation simply because it makes a more effective mechanical buffer between the lens and the corneal epithelium. It has been found also that a hypotonic water layer—which results when a tap water rinse is used—may cause an unpleasant burning or stinging sensation in some patients. The protective film created by the wetting solution also helps to prevent smudging of the lens with oils and cell debris from the fingers or from accidental brushing against the eyelashes, lids, or nose during insertion.

Wetting solution was the first of the adjunctive materials developed for the purpose of overcoming some of the problems associated with the wearing of contact lenses. It was soon found that wetting solution alone was not enough. If the patient allowed his lenses to dry out between wearing periods, various difficulties arose: soluble impurities actually found their way into the substance of the lens while it was being worn, and remained behind when their solute evaporated during the dry period; and the surface chemical properties of the lens were so altered that in some cases re-wetting became difficult or impossible.[5]

*NOION, Barnes-Hind Ophthalmic Products, Inc., Sunnyvale, Calif.

For these reasons it became customary to store lenses overnight in tap water or distilled water. However, water alone proved inadequate, and a special hydrating solution* had to be developed.

The proper storage of contact lenses requires total immersion of the lenses in a specially formulated hydrating solution, i.e., a soaking solution. Only in this way can the lens surface be kept free from chemical impurities found in the water itself, and only in this way can it be kept wet. A smudged lens placed in water overnight will come out smudged in the morning—unless the contaminating substance is soluble in water, which is seldom the case—and that part of the lens underlying the water-insoluble contaminant will have been dry all that time.

The use of tap water for the storage of contact lenses should be discouraged. The chlorine which it usually contains is irritating to the sensitive ocular mucous membranes; and its solid content, commonly referred to as "hardness," favors the deposition of insoluble calcium salts upon the surface of the lens.

Since total immersion of the lens implies free floating in the soaking solution, various carrying cases have been developed to serve this purpose. A good carrying case should have sufficient void volume to accommodate at least 2.5 cc. of soaking solution per pair of lenses. In testing several of the contact lens carrying cases commercially available, we were particularly impressed by Hydrakit** which meets all of the rigid specifications found most desirable in theory and practice. The Hydrakit® allows complete immersion of the lens in the hydrating fluid, and its ingenious design prevents accidental damage to the lens. Testing at high altitudes has confirmed the claims made for its leak-proof design.

MICROBIAL CONTAMINATION

The incidence of bacterial and fungal eye infections among contact lens wearers *versus* the incidence in the general population has not been well studied. Conjunctivities and keratitis do occur in these people, but it is not known to what extent the use of contact lenses can be held responsible for introducing the infecting organisms into the eye. Conjunctivitis is a common and unpleasant but not a serious disorder which can usually be cleared up in a few days by appropriate medical treatment. Infection of the cornea is fortunately much less common but unfortunately far more serious, since permanent blindness can result.

The cornea is protected from accidental contamination by its overlying epithelium. Under ordinary circumstances, airborne contaminants

*SOQUETTE®, Barnes-Hind Ophthalmic Products, Inc., Sunnyvale, Calif.
**Plastic Associates, 1122 W. Magnolia Blvd., Burbank, Calif.

which find their way onto the surface of the eye are unable to pass this barrier and establish an infectious process. However, the contact lens wearer is perhaps more prone than other people to the extraordinary circumstance. While the patient is wearing his lenses—or while he is inserting them or even removing them—something *may* happen which will interrupt the continuity of that epithelial barrier and permit bacterial or fungal organisms to lodge themselves in the highly susceptible corneal tissues. The cornea also happens to be the best-known culture medium for *Pseudomonas aeruginosa*, a widely distributed contaminant which can destroy the cornea overnight. For this reason, common logic urges us and professional conscience compels us to take every possible precaution against bacterial and fungal contamination of contact lenses.

In the task of ensuring that the surface of the lens will be bacteriologically "clean"—we avoid the term "sterile" since the patient is after all manipulating his lenses—the major share of the responsibility falls upon the hydrating or storage solution. Most wetting solutions are sterile and contain antibacterial agents, but the exposure of contaminants to wetting solution—particularly if the patient persists, as some will, in rinsing his lenses before insertion—is so brief that we have accomplished all we can in simply assuring ourselves that the wetting solution itself shall not be a source of contamination. Soaking solution, on the other hand, can take on the task of ensuring that bacterial contaminants are destroyed before the lenses are removed from storage. Our own soaking solution* has been tested for antibacterial and antifungal properties. The results of these studies have been recently reported.[6] In the testing procedures heavily contaminated fluid cultures were inoculated into Soquette® Solution and the solution was examined for live organisms at intervals of 1, 2, 3, 5, 10, 20, and 60 minutes. After only 5 to 10 minutes, depending on the test organism, the solution was found to be sterile.

The same tests performed on Wetting Solution yielded similar results—although as has been pointed out the lens does not usually remain in contact with the wetting solution for anything like five minutes. It should be added that the wetting solution was further tested under actual conditions of use over a period of 45 days and that it maintained its self-sterilizing capacity throughout that time.[7]

Contact lens wearers should be cautioned against using saliva to wet their lenses before insertion. Saliva is an effective wetting agent, but grossly unhygienic; and the fact that some patients seem to get away with it is still no justification for its use.[8]

*SOQUETTE®, Barnes-Hind Ophthalmic Products, Inc., Sunnyvale, Calif.

Patients should also be cautioned against using tap water or even distilled water as a storage solution for their lenses. Tap water is always contaminated with bacteria, and frequently with the dread *Pseudomonas* organisms. Tap water is also a fairly efficient culture medium for most of the organisms commonly found in it, so that whatever organisms may be present as the storage container is filled can be expected to multiply overnight.[9] Nor can these objections be overcome by using distilled water. Water for Injection, U.S.P., is certainly sterile, but this is not true of the distilled water usually supplied for various purposes by the pharmacist. And distilled water, like tap water, is a satisfactory culture medium, which further renders it quite inadequate for lens storage.

RECOMMENDATIONS FOR HYGIENIC CARE AND STORAGE OF LENSES

The following summary of concrete suggestions on "Contact Lens Care and Wetting Procedures"* has been found to be a useful tool for the contact lens practitioner in instructing his patients:

I. *Clean your lenses when you take them off:*

1. Wash your hands and fingertips vigorously with a mild non-ionic hand cleanser, and rinse well with water.
2. Remove your lenses.
3. Spread a few drops of WETTING SOLUTION on the right lens.* Be sure to cover the edge of the lens as well as the inner and outer surfaces with WETTING SOLUTION.

   *If you always manipulate the lens for the right eye first, you will always know which lens you are holding: if there is "one left," you will know it is for the left eye.
4. Rub lens between thumb and forefinger for one full minute. Should lens become "gummy," apply more WETTING SOLUTION and continue to rub.
5. Rinse this lens and inspect it carefully against the light. If smudges or foreign particles remain, clean it again until it is clear.
6. Repeat the same procedure with the other lens.

   NOTE: If it is inconvenient to clean your lenses immediately, place them in your hydrating kit and clean them at the first opportunity.

II. *Store your lenses in a hydrating kit:*

1. Choose a hydrating case recommended by your contact lens practitioner for lens storage.

   Do not store your lenses dry.

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2. Fill the hydrating kit with sufficient SOQUETTE® SOLUTION to cover the lenses.
3. Store or carry your lenses in the hydrating kit after thorough cleansing.
4. Clean the hydrating kit and refill with fresh SOQUETTE SOLUTION at least twice a week. Rinse the kit with water after cleaning, and rinse again with SOQUETTE SOLUTION before refilling.

III. *Apply WETTING SOLUTION before inserting lenses:*

1. Wash your hands and fingertips vigorously with a mild non-ionic hand cleanser, and rinse well with water.
2. Remove the right lens from the hydrating kit.*
   *The lens can easily be picked up with one finger if a drop of WETTING SOLUTION is placed on the fingertip.
3. Gently cover all surfaces of the lens with WETTING SOLUTION.
4. Insert the lens with or without rinsing.
5. Repeat the same procedure with the other lens.

SUMMARY

Most of the problems patients have with their contact lenses can be solved by teaching the patient how to care for his lenses hygienically.

The problem of bacterial and fungal contamination of lenses can be solved by the proper use of appropriately compounded storage solutions.

The proper use of wetting solution is the single greatest aid to patient comfort since it cooperates with the storage solution to maintain a clean lens for insertion into the eye and because it serves as a "buffer" between the edges of the lens and the surface of the eye.

The positive steps outlined in the recommendations above will increase patient acceptance of contact lenses. These procedures are simple, effective, and can be easily learned. They can also be easily forgotten. The indoctrination of the patient must bear down heavily on the *reasons* for the use of wetting solution and soaking solution and the reasons for hand cleanliness. The contact lens fitter must never tire of insisting that these recommendations be followed exactly as given.

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ANNOUNCEMENT

INTERNATIONAL OPHTHALMIC OPTICAL CONGRESS

The last International Ophthalmic Optical Congress was held in London in 1951. The success of that meeting has prompted the organization of another on an equally large scale. The coming Congress will run for a week in London, July 5-12, 1961. Papers will be presented by prominent optometrists from all over the world. Several Academy members from the United States have been scheduled to speak and it is hoped more will arrange to do so. During the same period the British Ophthalmic Trade Fair will also be held in London and the International Optical League will hold its 1961 annual meeting in the same city on July 10. These are important meetings and all U.S.A. and Canadian optometrists are invited to attend. Additional information may be had by writing to Miss I. Parnum, Hon. Secretary, International Optical League, 65 Brook St., London, W.1, England.

A SHORT REVIEW OF VITAMINS AND THEIR PLACE IN MAINTAINING HEALTH*

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Research on vitamins and vitamin therapy is a dynamic thing in a constant state of change. This is a short review of vitamins and the progress made in this field. Because vitamins are so widely used and prescribed by physicians it is of interest to the optometrist to understand their significance. The information taken in case histories many times includes a story of the patient having to take one or another of these vitamins. Knowledge of vitamins gives the optometrist a basis for interpreting the case history of some of his patients. It also gives him information on symptoms of ocular discomfort resulting from vitamin deficiencies which may require a patient to be referred to the medical profession for treatment.

Although vitamins are as old as life itself, man's acquaintance with these strange substances is so new that scientists are still making important dicoveries about them. No one knows exactly how many vitamins occur in nature. Not so many years ago it was thought that there were only six: then a dozen or more: now, even far more. Vitamin research has isolated many, and probably will continue to uncover numbers of new vitamins in the future.

Because the small traces of vitamins found in food substances are easily overlooked, their importance was not known until about 40 years ago. Since that time so much has been written about vitamins that they are well known popularly. The name has become a household word, but it is still difficult for the biochemist even to define vitamins as a group. For one thing, they make themselves known by their lack, so that their positive functions must be sought indirectly. Research has only begun to uncover the primary physiological actions of vitamins. Then it may be that there is so much overlapping among vitamins and other related groups of substances that the classification is not a good one. Even the name *vitamin* may not be apt, but is now too widely accepted to be dislodged.

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There are numerous definitions of the term vitamin. The most appropriate, we believe, is expressed in a small pamphlet, *The Original Vitamin-Mineral Digest*. This pamphlet states that, "vitamins are organic food substances, usually originating in the vegetable kingdom, of which very small quantities are needed for growth, for maintenance of appetite and for proper functioning of tissues and cells." They are a part of the chain of body processes which must not be broken. They seem vital to mankind's health.

The vitamins were discovered after years of painstaking research by scientists scattered over the entire world. The first important step was the realization that scurvy, rickets, and beriberi . . . now known as vitamin deficiency diseases . . . were caused by unbalanced diets. Historical points in the discovery of vitamins date back to 1601 when scurvy was cured by fresh fruit and vegetables.

The original list of vitamins, if the word original can be used in this context, contained a basic seven. Vitamin A, B_1, G, C, D, E, and K, were at one time thought to be the vitamins essential to life. The present list brought up-to-date by research is by no means as small. Its number, though variant according to different authorities, is approximately 83. The known vitamins and vitamin substances which have been brought out by research are: Vitamin A_1, A_2, Neovitamin A, a-Carotene, b-Carotene, c-Carotene, Cryptoxanthine; Vitamin B, the vitamin B complex consisting of Vitamin B_1, B_2, B_3, B_4, B_5, the B_6 group consisting of Pyridoxine, Pyridoxal, and Pyridoxamine, Vitamin B_7, B_8, B_9, B_{10}, B_{11}, the B_{12} group, consisting of $B_{12}a$, $B_{12}b$, $B_{12}c$, $B_{12}d$, Vitamin B_{13}, B_{14}, B_{15}, Bc, Bp, Bt, Bw, Bx, Nicotimamide, Nicotinic acid, Pantothenic acid, Biotin, Choline, Inositol, p-Aminobenzoic acid, the Folic acid group consisting of Pteroyiglutamic acid, Pteroyltriglutamic acid, Pteroylheptaglutamic acid, Folinic acid; Vitamin C, C_2, the Vitamin D group consisting of D_2, D_3, Vitamin E group consisting of a-Tocopherol, b-Tocopherol, c-Tocopherol, etc.; Vitamin F, Vitamin G, Vitamin H, Vitamin I, Vitamin J, Vitamin K group consisting of Vitamin K_1, K_2, Menadione, etc.; Vitamin T, Vitamin U, Vitamin V, Vitamin W, Vitamin X, Vitamin Y.

The vitamins vary widely in their chemical structure and in the functions they perform. Vitamin A, now believed to be the most important vitamin to vision, is created (and some of it destroyed) in the eye in the process of seeing. Its absence from the diet may cause a serious eye disturbance; its deficiency may create night blindness and the inability to see in dim light. The fundamental metabolic action of vitamin A is not completely known. This dietary factor seems to be re-

quired, however, by man and other animals to maintain normal body growth and the health and integrity of certain specialized epithelial tissues. Its presence or lack is measurable by adaptation of vision to dim light. Dark adaptation depends on the formation of visual purple, or rhodopsin, a photosensitive chromoprotein in the retina whose bleaching and subsequent regeneration is believed to be accompanied by utilization of vitamin A. If the vitamin's supply is inadequate, rhodopsin is not regenerated at a normal rate and the eye does not readily adapt itself to the twilight vision or darkness. It is thought that vitamin A also stimulates appetite and normal digestion; helps keep the skin moist; is essential for reproduction and for the growth of the young. Contrary to popular opinion, it is incorrect to call vitamin A the "skin vitamin" because it is just as important to the eyes and other tissues as it is to the skin. Vitamin A deficiency may decrease the growth of bones and teeth; excessive doses of the vitamin, on the other hand, is believed to accelerate bone growth. In the absence of vitamin A, columnar and cuboidal epithelia tend to degenerate into stratified squamous epithelium and the tendency toward cornification in stratified squamous epithelium increases. This begins in the lids, and later involves the cornea. They become dry and the cornea becomes opaque. The changes in the tissue, except when they involve the skin, are usually detectable only at autopsy by microscopic examination. It has been suggested that a shortage of vitamin A and calcium might be a cause of nearsightedness.

Experimentally, the effects of vitamin A deficiency produced in animals abnormalities in bone growth, failure to gain weight, xerophthalmia, night blindness and cornification of epithelial surfaces. Both deficiency and excessive intake of the vitamin have been implicated as causes of congenital anomalies. In man vitamin A deficiency reveals itself specifically in night blindness, characteristic dermatoses, and xerophthalmia. Lack of the vitamin may also be a contributory factor in retarded growth.

Since vitamin A is stored, a deficiency of this vitamin is relatively rare. Many of the important sources of vitamin A are dairy products, green vegetables, carrots, eggs, liver and apricots. The international unit for vitamin A equals in activity 0.6 micrograms of pure b-carotene. The approximate average daily requirement of vitamin A is 4,000 international units for adults. Children need less while expectant and nursing mothers need more.

* * * * *

In the early days of vitamin research, vitamin B was thought to be a single substance. Today it is known to be marvelously complex.

representing at least six vitamin fractions of varying function. The first of these factors, frequently missing from the average diet, is the one which affects appetite, the digestive functions, and the structure of the nerves. Important to children, since it plays a role in growth: important in the utilization of the starches and sugars in the diet and important for proper digestion, this principle is known as vitamin B_1 or thiamine. The general results of deficiency of vitamin B_1 are general weakness, nervousness, poor appetite, gastric and intestinal disturbances, decreased peristalsis, and poor lactation. A relative deficiency in vitamin B_1 may occur when processed carbohydrates form a large part of the diet, and the intake of B_1 falls or remains stationary. This creates a relative deficiency. The intake of B_1 might be "normal," but under such circumstances is relatively insufficient. To its insufficiency are attributed many of the common disorders of the alimentary tract so frequently occurring in residents of urban areas. Contrary to public opinion the average diet does not supply sufficient B_1 or thiamine. It is the opinion of authorities that the average diet supplies inadequate amounts of this vitamin. Many hospital diets, and restricted diets, often show particular deficiencies in vitamin B_1, among other vitamins. Children receiving a supposedly "perfect" diet have nevertheless shown an improvement in appetite and general response when given additional quantities of vitamin B_1. Since vitamin B_1 can be stored only in small amounts in the liver it must be replenished daily. It is believed important to children because of its seemingly outstanding properties of accelerating growth and increasing weight in early childhood. It must be remembered, however, that all the proved vitamins and the essential minerals are of importance to both child and adult. Vitamin B_1 is the paradox among vitamins, rather widely distributed in nature: widely absent from the average foods in the diet. Vitamin B_1 is found in green vegetables, egg yolks, liver, tomatoes, nuts, oysters and grapes. The international unit for vitamin B_1 equals the activity of 3 micrograms of thiamine hydrochloride. The average daily dosage is 10 to 20 micrograms.

The second B vitamin in the vitamin B complex is B_2, sometimes called G. Vitamin B_2, correctly known as riboflavin, is the vitamin which joins B_1 in affecting utilization of carbohydrates and proper functioning of the digestive tract. It is necessary for the skin, for the eyes, and for the maintenance of the processes which the body employs to utilize the protein of foods.

Vitamin B_2 (G) improves growth and is very important to children: it promotes health and has a definite effect on the lifespan. Ani-

mals fed a B_2 deficient diet display premature senility. Most frequently reported clinical sign of vitamin B_2 deficiency is vascularization of the cornea although many of the reports have probably included cases involving nothing more than pericorneal injection and hyperemia. The injection and proliferation of limbic vessels can be seen at first only with a slit-lamp or hand lens. In advanced cases capillaries may invade the entire cornea and there may be ulceration and secondary infections. Other ocular signs of ariboflavinosis are conjunctivitis, blepharospasm, increased lacrimation, photophobia, changes in the pigment of the iris, and disturbances of vision.

Other results of vitamin B_2 deficiency are digestive disturbances, lack of vigor, impaired growth, cataracts (in extreme cases), loss of hair, ulceration of the tongue and loss of weight. A lack of vitamin B_2 also participates in the production of pellagra symptoms. Since vitamin B_2 is stored only to a limited extent in the body it is necessary to replenish the supply frequently. Fortunately vitamin B_2 is widely distributed in nature. It is found in green vegetables, bananas, prunes, liver, kidney, veal, beef, egg and malted milk. The approximate average daily requirement of vitamin B_2 is 2,000 micrograms for the adult, 1,500 for adolescents, 500 for infants, and above the average, 2,500 for expectant mothers and 3,000 for middle-aged and aged groups.

Vitamin B_4 or choline occurs as a constituent of phospholipids and is related to the metabolism and distribution of fats. It is being used in the treatment of hepatic cirrhosis as choline chloride.

Vitamin B_5 or niacin is important mainly in preventing pellagra, a disease characterized by mental, neurologic, cutaneous, mucous membrane and gastrointestinal symptoms. This vitamin is widely found in wheat, milk or egg protein. In normal adults, the daily requirements of niacinamide average 5mg./1,000 calories.

Many of the symptoms of vitamin B deficiency may be precancerous. It has been reported that people who had troubles with their mouth, tongue, lips, gums, or have burning sensations, ulcers, boils or patches of inflammation on their gums are niacin deficient. White spots may have appeared on the gums or inside of cheeks, tongues are smooth and shiny or swollen and deeply fissured, the corners of the mouths have cracks, or sores, and these too are symptoms of a niacin deficiency. It has been said that certain cancers can be prevented even after precancerous symptoms have appeared by following the proper diet including large doses of the B vitamins. Vitamin B_6 or Pyridoxine is present in the average diet in sufficient amounts so that deficiencies of this vitamin are rather rare. Deficiencies may be caused in infants fed on artificial

formulas. Symptoms of such deficiencies are epileptic form convulsions, impaired growths and hypochromic microcytic anemia. The difficulty here is to differentiate these symptoms of vitamin B_6 deficiency from identical symptoms from other causes. It has been shown that this vitamin is obviously vital in encouraging anti-infection organisms in the blood stream.

Vitamin B_{12} is in the process of experimentation and evaluation. A report was given at the 1951 meeting of the Medical Society of the Paris Hospitals by Lereboullet and Pluvinage on the use of vitamin B_{12} on 43 patients with neurological disease. Many registered improvement. Therapy using B_{12} is being tried on those having multiple sclerosis, spastic paraplegia, spinocerebellar symptoms of the acromegaly type, cerebeller atrophy, Herpes Zostre, psoriasis, seborrhea (a skin disease) showing yellowish or greasy scales on the body usually marked by itching; another skin disease, Lupus Erythematosus (reddish patches, depressed centers covered with scales or crusts), and in healing skin breaks. There seems to be a factor in the stomach called the "intrinsic factor" which is necessary for assimilation of B_{12}, and this may not be present in some individuals. Research of this vitamin continues on many fronts.

* * * * *

Vitamin C with its closely allied vitamin P favors good bone and tooth formation and is vital to the health and resiliency of blood vessels. It also cooperates with the other vitamins in the defense mechanism against infection and bacterial poisons. Since it is very easily destroyed, deficiencies in vitamin C appear to be much more common than would be supposed. The comparatively wide distribution of vitamin C in nature would seem to preclude such deficiencies under normal circumstances. Yet examinations of the gums of school children have disclosed strikingly high percentages of borderline deficiencies. Deficiency of vitamin C is characterized by weakness, headache, restlessness, impaired digestion, tenderness of the joints, defective teeth and gums, and lowered resistance to infection. Bleeding of the gums is also considered to be a vitamin C deficiency.

Deficiencies in vitamin C exist mainly because the vitamin is destroyed before the individual has the chance to utilize it. Air attacks the vitamin; ordinary cooking may destroy it; pasteurization depletes it; and ordinary air drying destroys it. Speeding of canning operations of fruits which contain it, and canning under partial vacuum have eliminated some of this destruction. Good sources of vitamin C are in certain vegetables and fruits. The foods rich in it are orange, pineapple, apples, grapefruit, bananas, peas, tomatoes, liver, lemon, spinach, pep-

pers, and horseradish. The international unit for vitamin C equals the activity of 50 micrograms of ascorbic acid. The average daily requirement of vitamin C is 600 international units with less for younger persons and more for older persons and expectant mothers.

Vitamin P, generally found with vitamin C, is considered a citrus bioflavinoid, and is claimed to be necessary for the body especially in middle and advanced age, for it is thought that this vitamin keeps the walls of blood vessels pliable and resilient, thus at least partially offsetting possible hypertension.

* * * * *

The exact composition of Vitamin D is not known: there are probably a number of different forms. It is created by the body from a substance beneath the skin when solar radiation falls upon the surface of the body. Nature provides very little vitamin D in the usual foods, but cod liver oil fortunately is a rich source if vitamin D and also vitamin A. It is interesting to note that vitamin D is particularly related to vitamin A. Vitamin D should be present in the diet in the proportion of about one part D to seven parts A. Intake of vitamin D should always be accompanied by intake of calcium and phosphorus.

In moderate amounts, the vitamin promotes retention of calcium and phosphorus and maintains concentrations of these elements in the blood that will permit deposition of lime salts in the formation of bone. A hypothetical relationship has been suggested often, without ever being confirmed, that there is a relationship between vitamin D and the parathyroid function. This combination deals with calcium and phosphorus metabolism but the effects of the parathyroid hormone is, in detail, somewhat different from the effects of vitamin D.

Deficiency in vitamin D is characterized by dental cavities, constipation, lack of vigor, retarded assimilation of certain minerals, restlessness, and other disturbances. Vitamin D deficiency is best known to be the cause of rickets. Sources of vitamin D are milk products, eggs, oysters, sardines, clams and liver. It is practically absent from most cereals, vegetables, and fruits. Fish liver oils are rich sources of vitamin D. However, it is not possible to recommend the use of the usual foods as the sole supply of vitamin D. The quantities which would have to be eaten would be very large. Vitamin D is available to everyone through exposure of the skin to the ultra violet radiations found in sunshine, or through ingestion of cod liver oil or concentrates of various fish liver oils. The international unit for vitamin D is equal in activity to .025 micrograms of calciferol. The approximate average daily requirement of vitamin D is 400 international units. Children and adolescents also

need the same amount: however, expectant mothers need twice the amount.

* * * * *

Vitamin E is a necessary factor in growth after sexual maturity is achieved. It promotes lactation and has an effect on some of the muscles. Vitamin E apparently has a specific effect upon the processes involved in reproduction. In general, this vitamin is present in adequate amounts in our daily diet. It is found in linseed, lettuce, spinach, watercress, milk, eggs, muscle meats, fish, peanuts, molasses, legumes, and whole grains. The human requirements are not definitely known. The effects of vitamin E deficiency have been observed accurately in animals, but the knowledge of the deficiency symptoms in man is still scant. Two Paris physicians report in the French medical journal, PRESSE MEDICALE, April 25, 1959, that vitamin E is instrumental in strengthening the collagenous fibres of the sclera thus making the globe more firm and less yielding to the pull of the extra ocular muscles. They have an outlined therapy of 50 milligrams of vitamin E each day for three months, then a lay-off of several weeks, and again the same dosage for three additional months. This, it is claimed, in conjunction with a high protein diet not only prevents but also helps decrease deteriorative changes within the eye. Vitamin E is being tried on many ills now. It is being used to prevent miscarriages, to lessen pain, to cope with muscular dystrophy, in treating Buerger's disease: it has been used to heal ulcers and psoriasis: it has been used to treat phlebitis, and to alleviate the pains of angina. One of the most active centers of vitamin research is on vitamin E. It has been recently decided by the U. S. Food and Drug Administration that vitamin E *is* essential to human nutrition. The exact amount has not been established.

The last of the vitamins that will be mentioned is vitamin K, a blood clotting vitamin. When patients with vitamin K deficiency need surgery they generally are given vitamin K before the operation, to prevent the sudden fall in prothrombin level that sometimes occurs. Since vitamin K is not stored readily the prothrombin level must be followed after treatment is discontinued. What storage there is occurs in the liver.

The review of certain vitamins given here is extremely condensed. It should be realized, however, that attention must be given to the type of food eaten, the quantities of those foods, and the proportions that they are eaten in order to assure proper vitamin balance.

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CHICAGO, ILLINOIS

NOTES ON PSYCHOLOGICAL FITTING IN CONTACT LENS PRACTICE*

O. Ashley Williams†
Sydney, New South Wales, Australia

The psychological fit of a contact lens results from all the problems concerned with the psychological build-up, reaction, and readjustment of the patient to the wearing of a refractive correction on the cornea. It includes such aspects as fear, doubt, lack of confidence, worry and disappointment. The all important aspect of motive is to be considered as a separate entity of utmost importance in itself. The practitioner is not concerned with the patient without initial motivation, although at times he may be obliged to expose one. The term "physical fit" will be regarded as covering aspects of the anatomical fit with due consideration to the physiology of the eye. A good physical fit is one which will allow maximum anatomical tolerance. It should be stressed that the psychological fit is based upon the *attitude* of *all* those concerned with the case. Included in this is, of course, the patient himself. Further, psychological fitting should start the moment the patient mentions contact lenses.

THE ATTITUDE OF THE PRACTITIONER

The whole picture associated with the psychological fit is based upon the attitude of the practitioner. This is the foundation of everything in contact lens fitting and, of course, forms the basis of every aspect of the work. The fitter must have an attitude of complete confidence in his own ability, and in contact lenses as the ultimate in visual correction. The patient is then instilled with an attitude of complete confidence in contact lenses and his own ability to wear and handle them successfully. This confidence, present in the specialist, should also be imparted to the general optometric practitioner, for it is often the attitude of the patient's own general practitioner that makes or breaks a prospective wearer when the first interest is revealed. This is of course a very important part of an optometric specialist's work and should never be neglected.

The practitioner should be prepared and keen to fit any patient who presents himself. He should spare no effort to overcome the difficulties that might otherwise make the patient unsuitable. To the

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specialist every patient is suitable. Many aspects arise from this attitude and if it is not present in the practitioner, he should either cultivate it or leave the field to those who have it. It is obvious that most practitioners enter the field because of this attitude and, of course, it helps them to succeed.

THE ATTITUDE OF THE PATIENT

As already pointed out, the attitude of the patient is based upon that of the practitioner and it is essential that the patient possess confidence. The question of the motive must be considered separately as it is obvious that a patient will not seek treatment if there is no motive. It should be stressed, however, that where advantages are offered by contact lenses, the practitioner may have to demonstrate these to a patient who has as yet no motive. Such cases are rare but are mainly due to lack of knowledge of contact lenses and their capabilities. They are usually met by the general optometric practitioner and require a great deal of attention in order to create or disclose a motive. The patient who goes directly to the optometric contact lens specialist usually possesses a motive.

THE CONFIDENCE OF THE PATIENT

By the actions of the practitioner, his receptionist, and by those referring the patient, the confidence of the patient in corneal lenses is built to a point where he feels he could benefit from their use. This, combined with a motive, takes the patient to the next stage, confidence in himself to handle and wear the lenses. Both confidence in others and in himself are very closely interwoven but each may fail in itself and the whole system break down. Attention must be continually directed to these factors by the practitioner and any weakening of all or one of them must be avoided. The means to do this are based upon the attitude of the practitioner and it would be impossible to outline the many methods employed by different individuals to achieve this end.

It must be stressed that a good physical fit can be affected by a bad psychological fit and the case made a failure because of lack of attention to this aspect. The presence of a good physical fit will, of course, be one of the most potent forces in the establishment and maintenance of a good psychological fit. The practitioner will often be called upon to attack a bad psychological fit which has not yielded to a good physical fit, and he should never rely upon the physical fit as the sole means of establishing a good psychological fit.

THE MOTIVE

The practitioner will not be confronted with the patient who possesses a psychological fit which overrides his motive, but he will be con-

fronted with a patient who possesses a motive strong enough to override a bad psychological fit. This situation may require extra attention to the psychological fit if the physical fit is not strong enough. This situation is, to a large extent, based upon a general lack of acceptance of corneal correction and will improve as time progresses and wearing and fitting are improved and accepted by all.

When confronted with a patient who needs corneal correction but has no motive, the practitioner can but demonstrate the advantages to be gained by corneal correction: if the patient does not respond, the case will not be taken for obvious reasons. Several practitioners feel that if a patient is prepared to pay the fee, then a motive of sufficient strength has been established. This is usually a good basis, but in some the motive may be overpowered by other aspects as the fitting progresses.

INITIAL VISIT

As has been pointed out, the practitioner must at all times instil an attitude of confidence into his patient and during the first visit this is basic. Combined with this he must demonstrate his ability in the field and his utmost confidence in this type of correction. During this visit the patient will be mainly concerned with the "feel" of contact lenses and the best approach to this question is, of course, to fit a correctly fitting trial lens. The patient should be handled properly to instil relaxation and attention should be paid to fear and all the emotions which may be present when the patient is experiencing what in his own mind is something far worse than anything the dentist or physician can do to him. A full understanding of his situation should be the basis of the initial handling and it is essential that the practitioner be a contact lens wearer at some stage of his career. Demonstration of visual improvements may be necessary in cases where this is the motive.

The examination should be thorough and reasonably fast. To draw out the examination in order to impress the patient with the delicate and intricate nature of the work is occasionally essential but as a general rule such an approach destroys the confidence of the patient in his own ability to cope with the lenses. Should it be found that the patient is the type that expects special and prolonged treatment, this can be readily "supplied" in the later visits. If this type of patient can be recognized in the initial visit then the practitioner can readily alter his approach accordingly. During this visit, the basis of a good psychological fit is laid and the patient should leave the refracting room full of anticipation for the next visit when he will pick up his first lenses. He should realize that most patients achieve all day wear within four weeks (or whatever time used) and that he will be considered

unusual if this does not occur (by inuendo). Also he must realize that he must do the work himself and that failure may be his fault.

Further, his first pair of lenses *may* not be the final fit and adjustments may be necessary to improve the fitting as they progress. Do not let a patient think that the first pair is "the best you can do." This is very important, but it should not be overdone lest the patient not persevere.

INSTRUCTION VISIT

This visit is mainly concerned with instruction in the handling and care of the lenses by the patient. As previously, confidence is the basis and the patient should realize that the lenses are easy to handle. The practitioner should satisfy himself that the patient is able to do everything correctly. It should *not* be drawn out or made complicated. The patient should be impressed with the idea that once he becomes experienced the whole thing is as simple as putting a set of false teeth in the mouth. It is this visit that forms the basis of the psychological attack on the build-up period and the patient must leave with the idea that it is routine to build up in the specified time. Instructions should be given in the wearing times and certain difficulties that may arise should be outlined. This will vary according to individual patients.

It is good practice to give the patient the idea that the lenses should, if all goes well, be checked only when the patient is wearing all day. Most of the initial symptoms will have gone at this stage and the patient becomes satisfied that all is well without the practitioner's help. This is good psychology in most cases but does not work in others. The patient who needs help will of course be back for assurance. Adjustments, if only of a minor nature, will help those patients.

CHECKING VISITS

If the patient is pleased, a routine check is made of the fit and refraction and an attitude of "this type of case is routine" is adopted. The patient may be discharged or asked to return at a later date. If the patient is not pleased, then there must be a definite reason. The practitioner must of course display confidence and show the patient that this small upset sometimes occurs but is readily overcome. Always do something, as the unhappy patient expects a change of some kind and will never be content unless this is done. Do not, however, overdo this as you may destroy what was a good physical fit made useless through lack of wear.

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REFRACTIONS—WHO DOES THEM?

In Great Britain the Health Services keep accurate records as to the number of refractions performed each year and these are broken down to show exactly who did the work—the optometrist or ophthalmologist. These groups of records are probably the most exacting ones available among English speaking people and they show that the British optometrist is responsible for more than 70 per cent of this specialized health work. As these figures now cover a period of years and the results are more or less constant this large body of data must be accepted as final for this population of British patients.

Several years ago the Northern Ireland Hospital Authority published a report dealing with this same subject. In their findings 78 per cent of the refractions were made by Irish optometrists, 10 per cent by ophthalmologists and the remainder (12 per cent) were refractions done in hospitals, school clinics and arranged by local health authorities.[1]

[1]The Canadian Optometrist. 19.4.78.1957.

It is probable that most of the latter work was done by medical men.

From time to time refractive estimates dealing with the United States population are made. These are usually based upon the quantity of ophthalmic material consumed by optometrists, dispensing opticians and ophthalmologists. Here an attempt is made to trace the flow of lenses and frames from the manufacturer through the laboratory and then into the hands of the individual who finally dispenses the materials to the patient.

Obviously this type of analysis is open to many errors and best lends itself to those makers and distributors of materials who control both the manufacturing and laboratory distribution and who take the trouble to make reasonably accurate reports on these things for the U. S. Department of Commerce. On a dollar volume basis the following data was taken from a recent estimate.[2] Optometrists, it was claimed, used 55 per cent of the materials, dispensing opticians used 25 per cent and ophthalmologists used 20 per cent.

Since this report was released these findings have been widely quoted to show the substantial increase in the volume of refractions done by ophthalmologists as the combined total of purchases by physicians added to the purchases of the dispensing opticians equals 45 per cent of the total. This figure being some 25 per cent higher than the best estimates of several years ago when it was generally conceded that optometrists were doing at least 70 per cent of the refractive work done in the United States.

The data from which these figures are taken are open to question because of the possibility of error in compiling the data, as no manufacturer and laboratory distributor keeps books or records on this basis and thus his volume of sales has to be broken down in some more or less arbitrary way to come up with this type of report.

The figures are also open to question as a considerable volume of sales by every manufacturer are made to independent laboratories and these can only give rough estimates of who buys and uses the lenses and frames involved in the dollar totals. These objections, however, constitute only a relatively minor criticism of the U. S. findings under question.

In the judgment of the writer the main criticism of the findings is that the breakdown overlooks an important factor in the U. S. supply of ophthalmic lenses and frames. This is the cut-price frame maker and the basement manufacturer of ophthalmic lenses. These outfits

[2]The Dispensing Optician. June. 1957. Page 18.

taken singly are small, but they are many in number and their total volume of business is large and usually unreported. The quality of their products varies but on the whole the materials are hurriedly made to sell at a price. This entire volume of sales is, we believe, ignored in the basic data from which the U. S. figures were taken and the estimates made.

If the sales distribution of these cut price manufacturers followed the reported sales of the large suppliers the resultant findings in the end would not be changed. However, such is not the case. The majority of this material, it is believed, is absorbed by commercial optometrists and those individual optometric practitioners who are indifferent as to the quality of materials they dispense to their patients. Of this important volume of ophthalmic materials almost all falls in the hands of optometrists whom we believe should know better than to use this grade of material. Nevertheless, optometrists are using it, and as this volume of materials on a dollar basis equals from 20 to 25 per cent of the total, optometrists must therefore be credited with a considerably higher percentage of the refractions done in this country than 55 per cent.

It is therefore evident, the writer believes, that the U. S. refractive percentages already quoted are incomplete and unacceptable as these figures were derived entirely from a breakdown of a very large but not wholly inclusive volume of sales. To be, in any way, accurate the figures must be restudied to include an important (though regretted) dollar volume of materials, nearly all of which it is believed, is used by commercial optometrists. If and when this is done the total estimated volume of refractive work done by optometrists in the U. S. we feel will equal that of British and Irish optometrists.

CAREL C. KOCH

NEW BOOK RECEIVED

VISUAL FIELD DEFECTS AFTER PENETRATING MISSILE WOUNDS OF THE BRAIN. Hans-Lukas Teuber, William S. Battersby and Morris B. Bender. Published for the Commonwealth Fund by the Harvard University Press, Cambridge, Massachusetts. 142 pages. Illustrated. Cloth. $4.75. 1960.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

PROGRAM

AMERICAN ACADEMY OF OPTOMETRY

Sheraton-Palace Hotel
San Francisco, California

Post-Graduate Courses, December 7, 8 and 9, 1960
Annual Meeting of the Academy, December 10, 11, 12 and 13, 1960

WEDNESDAY, THURSDAY and FRIDAY, December 7, 8 and 9, 1960

8:00 A. M. to 10:00 P. M. American Academy of Optometry Post-Graduate Courses.* Apply at Registration Desk for tickets and Program. These courses are open to any optometrist.

10:00 A. M. to 5:00 P. M. American Academy of Optometry, Executive Council meetings. These meetings will be held in Suite 238-240 and 242. All Academy members welcome to attend sessions.

FRIDAY, December 9, 1960.

9:30 A. M. to 5:00 P. M. American Academy of Optometry, Committee on Admittance. Applicants and Committee will assemble in Suite 238-240 and 242 at 9:15 A. M. Here instructions will be given applicants to enable them to complete their Clinical Examinations.

GENERAL PROGRAM OF THE ACADEMY

Donald A. Springer, O.D., General Chairman, Anniston, Alabama.

SATURDAY, DECEMBER 10, 1960

8:30 Registration

10:00 Business Meeting

President's Annual Report
Lawrence Fitch, O.D.

Secretary's Annual Report
Carel C. Koch, O.D.

Announcements by Chairman of the Papers and Program Committee:
Donald A. Springer, O.D.

Announcements by Chairman of the Sections, under the Direction of:
John Zettel, O.D.

Arthur Shlaifer, O.D., Ph.D.
Section on Pathology

*For a detailed review of these 85 courses see following: Vincent J. Ellerbrock *et al.* Post-Graduate Courses of the American Academy of Optometry. Am. J. Optom. & Arch. Am. Acad. Optom. 37.8.421-434.1960.

Robert Graham, O.D.
Section on Contact Lens and Sub-Normal Vision
W. P. Schumann, O.D.
Section on Aniseikonia and Refractive Problems
Max Schapero, O.D.
Section on Orthoptics
Henry B. Peters, O.D.
Section on Occupational Optometry

10:40 Research on Eye Movements and Vision.
Frederick W. Hebbard, O.D., Ph.D.
School of Optometry, Ohio State University
Columbus, Ohio

11:05 Discussion

11:10 Electrophysiological Investigation of the Posterior Accessory Optic Tract—Transpeduncular Tract in the Rabbit.
Duco I. Hamasaki, Ph.D.
School of Optometry, University of California
Berkeley, California

11:35 Discussion

11:40 The Correct Preparation of Contact Lenses for Insertion on the Eye.
Don Brucker, O.D.
A. Harry Malin, O.D.
Consultant, Contact Lens Clinic,
Balboa Naval Hospital, San Diego, Calif.

12:00 Discussion

12:05 Luncheon Recess

1:15 Face to Face—Retarded Readers and Optometry.
Thaddeus R. Murroughs, M.S., O.D.
Santa Barbara, California

1:40 Discussion

1:45 The Objective Determination of the Visual Acuity Based on the Optokinetic Nystagmus.
Wm. P. Schumann, O.D. (Diplomoptiker)
Vineland, New Jersey

2:10 Discussion

2:15 Corneal Bending and Buckling in Tonometry.
Elwin Marg, O.D., Ph.D.
R. Stuart McKay, Ph.D.
Raymond Oechsli, A.B.
School of Optometry, University of California
Berkeley, California

2:40 Discussion

2:45 The Influence of Convergence on Accommodation.
Merrill J. Allen, O.D., Ph.D.
Professor of Optometry, Indiana University
Bloomington, Indiana

3:00 Discussion

3:05 A Telescopic Contact Lens for the Partially Blind.
William Feinbloom, Ph.D.
New York, New York

3:20 Discussion

3:25 On Schuberts' Accommodation Potential.
Niles Roth, O.D.
Berkeley, California

3:50 Discussion

3:55 The Relation Between Visual Acuity and Refractive Error at Three Age Levels.
Henry B. Peters, M.A., O.D.
Associate Clinical Professor
School of Optometry, University of California
Berkeley, California

4:10 Discussion

4:15 Contact Lenses: Comparison of Methods Used Around the World.
George N. Jessen, O.D.
Plastic Contact Lens Company
Chicago, Illinois

4:40 Discussion

4:45 A Longitudinal Study of Refractive State of Children During the First Six Years of School—A Preliminary Report of the Ojai Study.
Monroe J. Hirsch, O.D., Ph.D.
University of California
Berkeley and Ojai, California

5:10 Discussion

5:15 Adjournment.

SUNDAY, DECEMBER 11, 1960

9:00 Section Meetings

11:10 Anomalous Correspondence as a Function of Angle of Esotropia.
Merton C. Flom, O.D., Ph.D.
School of Optometry, University of California
Berkeley, California

11:30 Discussion

11:40 Some Unexpected Features of the CFF-Log I Relationship.
Gordon G. Heath, O.D., Ph.D.
Division of Optometry, Indiana University
Bloomington, Indiana

12:05 Discussion

12:10 The Accommodative Response to Targets of Different Size.
Bradford W. Wild, O.D., Ph.D.
School of Optometry, The Ohio State University
Columbus, Ohio

12:20 Discussion

12:25 Luncheon Recess.

1:30 A Critical Study of 149 Unselected, Non-operated Concomitant Strabismus Cases Completing Orthoptic Training.
William M. Ludlam, B.S., M.S., O.D.
Attending Staff, Optometric Center
New York, New York

1:55 Discussion

2:00 The Impact of Contact Lenses on a National Picture.
Newton K. Wesley, O.D., D.O.S.
Plastic Contact Lens Company
Chicago, Illinois

2:25 Discussion

2:30 A Typical Army Occupational Vision Program.
William B. Seigneur, O.D.
Occupational Vision Consultant
U. S. Army Environmental Hygiene Agency
Army Chemical Center, Maryland

2:50 Discussion

2:55 A Statistical Study of the Clinical Scores Obtained in the Wirt Stereopsis Test.
Arthur B. Emmes, O.D., B.A.
Castro Valley, California

3:05 Discussion

3:10 Clinical Statistics on the Stabilization of Myopia with Contact Lenses.
J. S. Nupuf, O.D.
Canton, Ohio

3:35 Discussion

3:40 Vision Information Program.
Robert W. Tubesing, O.D.
Richmond, Indiana

3:50 Discussion

3:55 Increases of Exophoria and Esophoria with Time after Disassociation.
C. B. Pratt, Ph.D., O.D., Professor
College of Optometry, Pacific University
Forest Grove, Oregon

4:15 Discussion

4:20 A Servo Method for Producing Equal Quanta, Equal Energy, or Equal Response Spectra.
Richard M. Hill, O.D.
Raymond Oechsli, A.B.
Elwin Marg, O.D., Ph.D.
School of Optometry, University of California
Berkeley, California

4:35 Discussion

4:40 Coffee Break—Served in Meeting Room.

5:20 An Improvement in Contact Lens Fitting.
Allan A. Isen, O.D.
Buffalo, New York

5:45 Discussion

5:50 A New Binocular Test at Working Distance (near).
Edward Goodlaw, B.A., O.D.
Los Angeles, California

6:10 Discussion

6:15 The Effect of Blur on Fixation Disparity.
Frederick W. Hebbard, O.D., Ph.D.
School of Optometry, Ohio State University
Columbus, Ohio

6:30 Discussion

6:35 A Model Clinical Program for Optometric Students.
Margaret Dowaliby, O.D.
Associate Professor in Clinical Optometry
Los Angeles College of Optometry
Los Angeles, California

6:55 Discussion

7:00 Retinoscopy Demonstration Projector
Merrill J. Allen, O.D., Ph.D.
Professor of Optometry
Indiana University, Bloomington, Indiana

7:10 Discussion

7:15 Adjournment

MONDAY, DECEMBER 12, 1960

9:00 Section Meetings

11:10 School Achievement and Visual Screening.
Lois B. Bing, O.D., Chairman
Comm. Visual Problems of Children, A.O.A.
Shaker Heights 22, Ohio

11:35 Discussion

11:40 Some Factors for Consideration in the Selection and Fitting of Children's Eyewear.
Roy Marks, O.D., D.O.S., President
Shuron Optical Company
Geneva, New York

11:55 Discussion

12:00 Luncheon Recess

1:15 Discomfort Glare.
Sylvester K. Guth, D.O.S.
Radiant Energy Effects Laboratory
General Electric Co.
Cleveland, Ohio

1:40 Discussion

1:45 The Development of Myopia in Monkeys.
Francis A. Young, Ph.D.
Dept. of Psychology, Washington State University
Pullman, Washington

2:05 Discussion

2:10 Evolutionary History of Eye Movements.
Gordon L. Walls, Sc.D.
School of Optometry, University of California
Berkeley, California

2:35 Discussion

2:40 The Role of Binocular Stress in the Post Whiplash Syndrome.
Raymond R. Roy, O.D.
Clinical Associate, Pacific University
Forest Grove, Oregon

3:10 Discussion

3:15 Transmittance of the Visible Spectrum Through the Components of the Bovine Ocular Media.
Donald G. Pitts, M.S.C., O.D., Capt., U.S.A.F. (MSC)
Research Optometrist, Aerospace Medical Division
Wright-Patterson A.F.B., Ohio

3:30 Discussion

3:35 An Economic Study of Ten Years Graduates.
James F. Wahl, O.D., Dean
College of Optometry, Pacific University
Forest Grove, Oregon

3:55 Discussion

4:00 Business Meeting.
Lawrence Fitch, O.D., Presiding

6:00 Cocktail Hour.

7:00 Annual Round Table Dinner.
Introduction of New Fellows by
Harold Simmerman, O.D.
Optometric State of the Nation
Richard C. Schiller, O.D., President A.O.A.
Marshalltown, Iowa
Presentation Honorary Life Fellowship to
Dr. Frank Weymouth
Los Angeles, California
Address by Dr. Weymouth

TUESDAY, DECEMBER 13, 1960

9:00 Section Meetings.

11:10 A Preliminary Report of Clinical Tests for Fixation Disparity.
Harold M. Haynes, O.D.
Visual Training Laboratory, College of Optometry,
Pacific University, Forest Grove, Oregon

11:35 Discussion

11:40 The Nature of Sensorial Adaptation in Anomalous Correspondence.
Meredith W. Morgan, Ph.D., Professor of Optometry and Physiological Optics, Dean, School of Optometry,
University of California, Berkeley, California

12:15 Discussion

12:20 Luncheon Recess

1:15 Aberrations of Contact Lenses.
Gerald Westheimer, O.D., Ph.D.
School of Optometry, University of California
Berkeley, California

1:30 Discussion

1:35 A Comparison of Shiotz Tonometer Findings on Cornea and Sclera.
Clair W. Bobier, M.Sc.
College of Optometry of Ontario
Toronto, Ontario, Canada

1:55 Discussion

2:00 Refractive Findings—1000 Consecutive Cases of Patients at a Municipal Home for Indigent.
Wm. G. Walton, O.D., Asst. Professor
Pennsylvania State College of Optometry
Philadelphia, Pennsylvania

2:15 Discussion

2:20 Biomicroscopy in Optometric Practise.
Bernard Mazow, O.D.
College of Optometry, University of Houston
Houston, Texas

2:50 Discussion

2:55 Adjournment

The individual programs for the five Section Meetings will be distributed at the Convention Registration Desk on Saturday, December 10, 1960.

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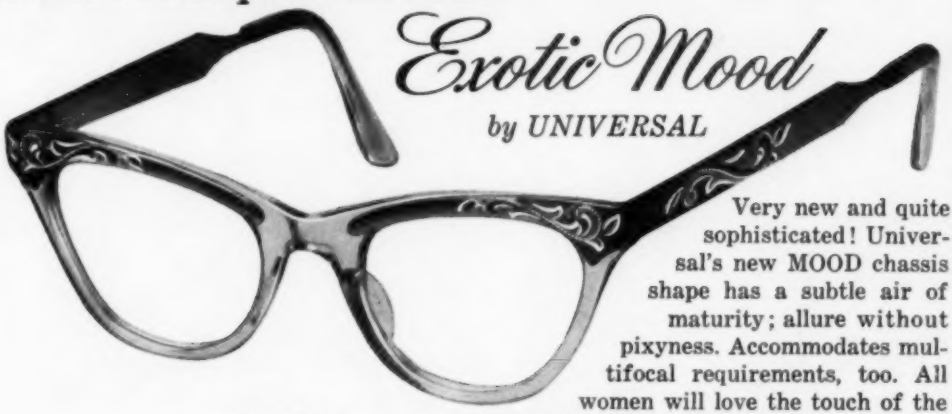

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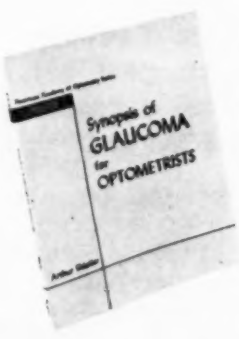

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